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A COMPARISON OF THE DISTRIBUTION OF TWO ISOPOD SPECIES (*CAECIDOTEA*) IN MASSACHUSETTS[1]

DOUGLAS G. SMITH, Museum of Zoology, University of Massachusetts, Amherst, MA 01003

ABSTRACT. The genus *Caecidotea* is represented by 2 species in Massachusetts, *C. communis* and *C. r. racovitzai*. *Caecidotea r. racovitzai* is restricted to western portions of the state while *C. communis* occurs throughout the state. Collections of *Caecidotea* sp. are demonstratively unispecific in drainages where both species are found. Subsequent collecting in 2 localities that formerly produced both species revealed only one species; however, in each case a different species had become dominant. The predominance of unispecific collections in areas of sympatry combined with the overall meristic and morphological similarity of the 2 species suggests that *C. communis* and *C. r. racovitzai* interact competively. However, other factors, such as physical characteristics of the environment, may be affecting the distribution of at least one species, *C. r. racovitzai*.

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INTRODUCTION

As part of an ongoing program to identify and catalog the aquatic invertebrate fauna of Massachusetts, collections of isopods of the genus *Caecidotea* (Asellidae) were made over a period of 7 years. Although some previous historical data exist as to the occurrence of *Caecidotea* (*Asellus* of earlier authors) sp. in Massachusetts (Gould 1841, Rathbun 1905), virtually every species identification, prior to Williams' (1970) revision, is suspect. Consequently it was decided to collect material over the entire state, including offshore islands, and using Williams' (1970) taxonomic revision, document which species occurred in the state and determine their distribution limits.

Much information is available regarding coexistence, non-coexistence and potential competition among similar species of European *Asellus* sp. (Wolff 1973, Rossi and Fano 1979, Williams 1979). To a lesser extent North American subterranean species of *Caecidotea* have been investigated with respect to interspecific competition (Culver 1973, Culver and Ehlinger 1980). However, very few observations have been made on North American epigean *Caecidotea* species.

The presence of *C. communis* and *C. r. racovitzai* within Massachusetts provided an opportunity to explore the extent to which coexistence occurs in these 2 species.

METHODS AND MATERIALS

Isopods were collected throughout Massachusetts from 1975 to 1982. A few additional earlier collections were also at my disposal for study. Specimens

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were collected by either dipnet or metal scrapper net and sorted by hand. Collected material was preserved in the field and eventually stored in 70% isopropyl alcohol. All specimens examined in this study have been deposited into the Invertebrate Division of the Museum of Zoology, University of Massachusetts at Amherst. Specific locations of collections have not been listed but can be furnished upon request.

Length measurements of males excluded appendages and were made to the nearest 0.5 mm by placing a subject on a metric rule and viewing it at 7X through a binocular dissecting microscope. All measured males were from samples collected between the last 2 weeks of April and the first 2 weeks of March when males were maximum size. Samples from which length measurements were derived consisted of 14-23 males.

RESULTS AND DISCUSSION

DISTRIBUTION. Williams (1970) recorded 2 species from the New England region, *C. communis* (Say) and *C. r. racovitzai* (Williams). However, in the absence of extensive collections for him to study, Williams (1970) was unable to determine the specific ranges of the 2 species in the New England area, and whether or not other species occurred there. Subsequently Bell (1971), following William's (1970) revision, discussed the distribution of *C. communis* and *C. r. racovitzai* in Vermont. Bell (1971) listed *C. r. racovitzai* as inhabiting only the Lake Champlain drainage in western Vermont whereas *C. communis* occurred throughout the state. No other species were recorded.

Extensive collecting (100 samples) by myself and others in Massachusetts thus far has revealed no species other than *C. communis* and *C. r. racovitzai*. *Caecidotea communis* is by far the most widespread species ranging throughout the state, extending to freshwater habitats on offshore islands as small as .64 km^2 (fig. 1). The distribution of *C. r. racovitzai* is restricted to west-central areas of Massachusetts where it has been found only in the Housatonic, Connecticut, and Merrimack River systems. In the Merrimack River system, the species is known only from one western tributary. The distribution of both species in Massachusetts is therefore somewhat analogous to Bell's (1971) analysis for Vermont.

Williams (1970) showed a general distribution pattern of *C. r. racovitzai* that had

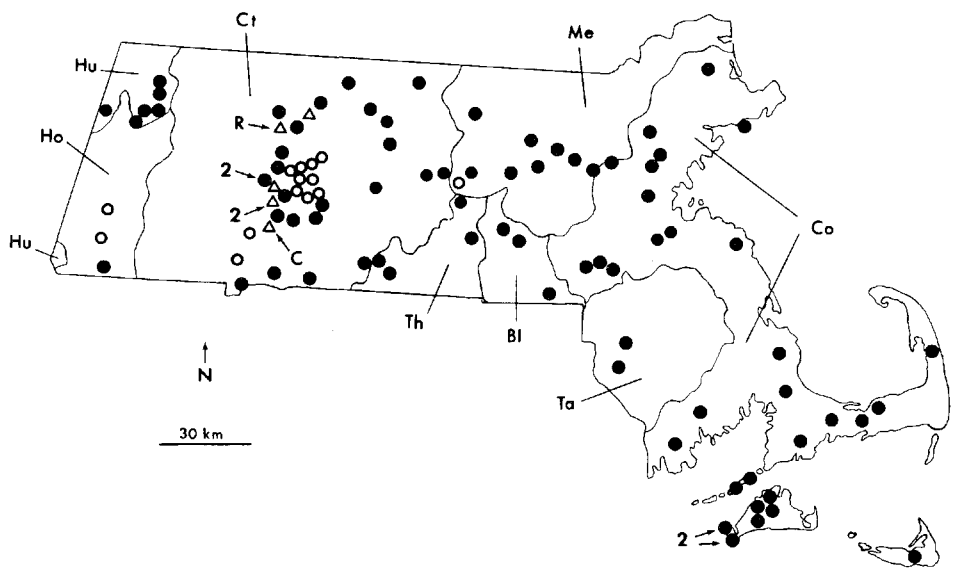

FIGURE 1. Distribution of *C. communis* (solid circles) and *C. r. racovitzai* (open circles) in Massachusetts. Triangles denote mixed species collections. R and C indicate localities previously with both species but presently dominated by *C. r. racovitzai* and *C. communis*, respectively. The number 2 signifies 2 proximal collections. Abbreviations are watersheds in Massachusetts: Hu = Hudson River, Ho = Houstonic River, Ct = Connecticut River, Th = Thames River, Bl = Blackstone River, Me = Merrimack River, Ta = Taunton River, Co = Coastal drainage.

its center in the Great Lakes region. He additionally indicated that *C. communis* was more concentrated in coastal drainages along the Atlantic seaboard of eastern North America. This information would lead to the conclusion that *C. r. racovitzai* probably entered New England from the west and north and that *C. communis* dispersed into New England from the south and south-west during late-glacial recolonization.

SPECIES COEXISTENCE. During the investigation, *C. communis* and *C. r. racovitzai* were found to be sympatric in the Connecticut River system (fig. 1). Among 40 collections made in the Connecticut River system only 6 contained both species. Based on collection data alone it appears that although the 2 species are sympatric, they infrequently occur syntopically. It has been proposed by some workers investigating other aselled species in sympatry (Hynes and Williams 1965, Culver 1973) that unispecific occurrences can be attributed to competition. However, without knowing absolutely if all samples in the present study were accurate representations of species composition then it is tenuous to assume that competition is going on between *C. communis* and *C. r. racovitzai* in Massachusetts.

Evidence was found indicating coexistence between *C. communis* and *C. r. racovitzai* is dynamic and fluctuations occur regarding species dominance. Two small isolated pond localities (Holyoke, Hampden Co., and Montague, Franklin Co.), both draining into the Connecticut River, were originally sampled in 1976 and 1977, respectively. Although the initial collections were small (n (♂) = 5,4), males of each species were detected with respective ratios of 3 : 2 and 3 : 1 (*C. communis* over *C. r. racovitzai*). Resampling in 1982 in each locality produced larger collections (n (♂) = 7,21) that were unispecific. In the Holyoke collection only *C. communis* was found (fig. 1, C) whereas in the Montague sample only *C. r. racovitzai* occurred (fig. 1, R). In all cases collections were made during the same time of year and time spent at each local was approximately equal. Why one species became dominant over the other, however, remains unknown.

Conditions for competition between the 2 species exist in so far as physical characteristics of the animals are concerned. Both species are extremely similar in overall morphology (Williams 1970, Bell 1971). The 2 species do not differ significantly in body size. Comparison of mean individual total length among unispecific populations of both species (3 each) reveals no statistical difference (ANOVA; $df = 1,4$; $F = 1.87$, $p > 0.05$). *C. r. racovitzai* is not widely distributed in Massachusetts. Physical and limnological features of the environment as well as interactions with *C. communis* limit its distribution and perhaps cause the absence or irregular representation of *C. r. racovitzai* in collections. Further study is needed to determine which biological and historical parameters affect the distribution of either or both species in Massachusetts.

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